

What is Claimed is:

1. An impact resistant material comprising:

a plurality of in-plane fibers defining a fabric plane; and

a plurality of upright fibers, wherein at least a portion of each upright fiber is oriented generally perpendicular to the fabric plane, said upright fibers comprising a ballistic fiber material.
2. The impact resistant material of Claim 1, comprising a non-woven, needle-punched material.
3. The impact resistant material of Claim 2, comprising a needlepunch density of at least 300 punches per square inch.
4. The impact resistant material of Claim 2, comprising a needlepunch density of about 400 to 550 punches per sq. inch.
5. The impact resistant material of Claim 1, wherein the ballistic fiber material is an aramid, a high performance polyethylene, a PBO fiber, a carbon fiber, a ballistic glass fiber or a ballistic nylon fiber.
6. The impact resistant material of Claim 5, wherein the ballistic fiber material has a fiber strength of at least about 3 grams/denier.
7. The impact resistant material of Claim 5, wherein the ballistic fiber material has a fiber stiffness of at least about 80 grams/denier.
8. The impact resistant material of Claim 5, wherein the ballistic fiber material has a fiber length of less than about 4 ½ inches.
9. The impact resistant material of Claim 5, wherein the ballistic fiber material has a fiber length of less than about 2 inches.
10. The impact resistant material of Claim 5, wherein the ballistic fiber material has a fiber fineness of no more than about 10.0 denier.

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11. The impact resistant material of Claim 1, wherein said upright fibers comprise at least about 25% of said material.
12. The impact resistant material of Claim 1, wherein said upright fibers comprise at least about 50% of said material.
13. The impact resistant material of Claim 1, having a weight of between about 2 ounces per square yard to about 4 ounces per square yard.
14. The impact resistant material of Claim 1, having an air permeability of at least about 4.1 CFM.
15. A ballistic resistant vest comprising the material of Claim 1, layered with a ballistic penetration resistant material.
16. A ballistic resistant vest comprising:
at least one layer of ballistic penetration resistant material; and
at least one impact resistant layer comprising a plurality of in-plane fibers defining a fabric plane, and a plurality of upright fibers, wherein at least a portion of each upright fiber is oriented generally perpendicular to the fabric plane, said upright fibers comprising a ballistic fiber material.
17. The ballistic resistant vest of Claim 16, further comprising at least one layer of ballistic resistant felt, said at least one impact resistant layer being sandwiched between said at least one layer of ballistic resistant felt and said at least one layer of ballistic penetration resistant material.
18. The ballistic resistant vest of Claim 16, comprising a non-woven, needle-punched material.
19. The ballistic resistant vest of Claim 18, comprising a needlepunch density of at least 300 punches per square inch.
20. The ballistic resistant vest of Claim 18, comprising a needlepunch density of about 400 to 550 punches per sq. inch.

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21. The ballistic resistant vest of Claim 16, wherein the ballistic fiber material is an aramid, a high performance polyethylene, a PBO fiber, a carbon fiber, a ballistic glass fiber or a ballistic nylon fiber.

22. The ballistic resistant vest of Claim 21, wherein the ballistic fiber material has a fiber strength of at least about 3 grams/denier.

23. The ballistic resistant vest of Claim 21, wherein the ballistic fiber material has a fiber stiffness of at least about 80 grams/denier.

24. The ballistic resistant vest of Claim 21, wherein the ballistic fiber material has a fiber length of less than about 4 ½ inches.

25. The ballistic resistant vest of Claim 21, wherein the ballistic fiber material has a fiber length of less than about 2 inches.

26. The ballistic resistant vest of Claim 21, wherein the ballistic fiber material has a fiber fineness of no more than about 10.0 denier.

27. The ballistic resistant vest of Claim 16, wherein said upright fibers comprise at least about 25% of said material.

28. The ballistic resistant vest of Claim 16, wherein said upright fibers comprise at least about 50% of said material.

29. The ballistic resistant vest of Claim 16, having a weight of between about 2 ounces per square yard to about 4 ounces per square yard.

30. The ballistic resistant vest of Claim 16, having an air permeability of at least about 4.1 CFM.

31. A liner for a ballistic resistant vest comprising at least one impact resistant layer, each said at least one impact resistant layer comprising:

a plurality of in-plane fibers defining a fabric plane; and

a plurality of upright fibers, wherein at least a portion of each upright fiber is oriented generally perpendicular to the fabric plane, said upright fibers comprising a ballistic fiber material.

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32. The liner of Claim 31, further comprising at least one layer of ballistic resistant felt, said at least one impact resistant layer being sandwiched between said at least one layer of ballistic resistant felt and said at least one layer of ballistic penetration resistant material.
33. The liner of Claim 31, comprising a non-woven, needle-punched material.
34. The liner of Claim 33, comprising a needlepunch density of at least 300 punches per square inch.
35. The liner of Claim 33, comprising a needlepunch density of about 400 to 550 punches per sq. inch.
36. The liner of Claim 31, wherein the ballistic fiber material is an aramid, a high performance polyethylene, a PBO fiber, a carbon fiber, a ballistic glass fiber or a ballistic nylon fiber.
37. The liner of Claim 36, wherein the ballistic fiber material has a fiber strength of at least about 3 grams/denier.
38. The liner of Claim 36, wherein the ballistic fiber material has a fiber stiffness of at least about 80 grams/denier.
39. The liner of Claim 36, wherein the ballistic fiber material has a fiber length of less than about 4 ½ inches.
40. The liner of Claim 36, wherein the ballistic fiber material has a fiber length of less than about 2 inches.
41. The liner of Claim 36, wherein the ballistic fiber material has a fiber fineness of no more than about 10.0 denier.
42. The liner of Claim 31, wherein said upright fibers comprise at least about 25% of said material.
43. The liner of Claim 31, wherein said upright fibers comprise at least about 50% of said material.

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44. The liner of Claim 31, having a weight of between about 2 ounces per square yard to about 4 ounces per square yard.
45. The liner of Claim 31, having an air permeability of at least about 4.1 CFM.
46. An impact resistant material comprising a plurality of fibers, at least a portion of said plurality of fibers comprising in-plane fibers defining a fabric plane, and at least 25% of said plurality of fibers comprising upright fibers having at least a portion of their length oriented generally perpendicular to the fabric plane.
47. The impact resistant material of Claim 46, wherein at least 50% of said plurality of fibers comprise upright fibers having at least a portion of their length oriented generally perpendicular to the fabric plane.
48. A method of fabricating an impact-resistant material, said method comprising:
- forming a fiber mat comprising at least one layer of fibers, said fiber mat defining a mat thickness; and
 - needlepunching said fiber mat to a depth of no more than about 1/3 the mat thickness.
49. The method of Claim 48, wherein said needlepunching step comprises needlepunching the mat at a density of at least 300 punches per square inch.
50. The method of Claim 48, wherein said needlepunching step comprises needlepunching the mat at a density of about 400 to 550 punches per sq. inch.
51. The method of Claim 48, wherein the step of forming a fiber mat comprises forming at least one layer of a mixture of aramid fibers and high-modulus polyethylene fibers.
52. The method of Claim 49, wherein the mixture fibers further comprises PBO fibers.

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